CLAIMS

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A welding power supply comprising:

an input rectifier configured to receive an input line voltage and provide a rectified voltage on an output;

a pre-regulator connected to receive as an input the output of the rectifier and provide a dc bus as an output; and

a convertor, connected to receive the output of the pre-regulator and provide a welding output;

wherein the pre-regulator is an SVT and a SCT switched convertor.

2. The power supply of claim 1, wherein the pre-regulator includes a snubber circuit having a diode that is SCT switched.

3. The power supply of claim 2, wherein the pre-regulator diode is SVT switched.

4. The power supply of claim 1, wherein the converter is a boost convertor including a switch, and the pre-regulator includes a snubber circuit having a capacitor and an inductor, wherein the capacitor is connected to slow the switch voltage rise while the switch is turning off, and the inductor is connected to slow the switch current rise when the switch is turning on.

5. The power supply of claim 1, wherein:

the boost converter includes a boost inductor, a switch, and an output capacitor;

the converter includes a snubber, including a snubber capacitor, a snubber inductor, a first snubber diode, a second snubber diode, a third snubber diode, a fourth snubber diode, and first and second snubber capacitors;

the snubber inductor, switch, and fourth diode are connected such that current may flow from the boost inductor to any of the snubber inductor, switch, and fourth diode;

current flowing through the fourth diode can flow through either the third diode or the second capacitor;

current flowing from the boost inductor through the snubber inductor can flow through either the first diode or the first capacitor;

the fourth diode and the second capacitor are connected across the switch;

current flowing through the third diode can flow through either the first capacitor and the snubber inductor or through the second diode; and

current flowing through the first and second diodes flows to the output.

6. The power supply of claim 4 further including a fifth snubber diode connected in anti-parallel to the switch.

7. A method of providing welding power, comprising the steps of:

rectifying an input line voltage;

pre-regulating the input line voltage to provide a dc bus; and

converting the dc bus to a welding output;

wherein the step of pre-regulating includes SVT and SCT switching a boost convertor.

8. The method of claim 7, wherein the step of pre-regulating includes the steps of:

maintaining a boost converter switch off, and allowing current to flow through a boost inductor, a snubber inductor, and a first diode, to the dc bus;

turning the switch on and diverting current from the snubber inductor to the switch;

reversing the current in the snubber inductor;

discharging a second capacitor through a first capacitor, a third diode, and the snubber inductor, thereby transferring energy from the second capacitor to the snubber inductor;

diverting current through a fourth diode, the third diode and the first capacitor when the second capacitor is discharged, thereby transferring energy from the snubber inductor to the first capacitor;

turning the switch off and diverting current through the fourth diode and into the second capacitor;

allowing the voltage on the second capacitor to rise until current begins to flow from the snubber inductor to the first capacitor;

diverting current from the second capacitor through a third diode to the second diode;

allowing the current flowing from the boost inductor to the snubber inductor to increase until all of the current from the boost inductor flows into the snubber inductor;

diverting current from the first capacitor to the first diode; and

repeating these steps.

9. The method of claim 7, further including the step of SVT turning off a diode in a snubber circuit.

10. The method of claim 9, wherein the step of SVT and SCT switching a boost convertor includes slowing the switch voltage rise with a capacitor while the switch is turning off, and slowing the switch current rise with an inductor while the switch is turning on.

11. A welding power supply comprising:

an input rectifier means for receiving an input line voltage and providing a rectified voltage;

a pre-regulator means for receiving the rectified voltage and providing a dc bus, wherein the pre-regulator means is connected to the rectifier means; and

a convertor means for receiving the output of the pre-regulator means and provide a welding output, wherein the converter means is connected to the pre-regulator means;

wherein the pre-regulator means includes SVT and SCT switching means.

12. The power supply of claim 11, wherein the pre-regulator means includes a snubber means having a diode that is SVT switched.

13. The power supply of claim 11, wherein the boost converter includes a switch, and the pre-regulator includes a snubber circuit means for providing the SVT and SCT switching.

14. A welding power supply comprising:

an input rectifier configured to receive an input line voltage and provide a rectified voltage on an output;

a pre-regulator connected to receive as an input the output of the rectifier and provide a dc bus as an output; and

an invertor, connected to receive the output of the pre-regulator and provide a welding output;

wherein the inverter includes a snubber circuit having a first switch in anti-parallel with a first diode, and a second switch in anti-parallel with a second diode, and wherein the combination of the first switch and first diode are connected in series with the combination of the second switch and the second diode, and wherein the first and second switches are connected in opposing directions.

15. A welding power supply comprising:

a first current path through a transformer in a first direction, the first current path including at least a first switch with an anti-parallel first diode;

a second current path through the transformer in a second direction, the second current path including at least a second switch with an anti-parallel second diode;

a snubber, including a current path having a third switch with an anti-parallel third diode, a fourth switch with an anti-parallel fourth diode, wherein the third switch and anti-parallel diode are in series with, and oppositely directed from, the fourth switch and anti-parallel diode, and at least one snubber capacitor.

16. The power supply of claim 15 wherein the first and second switches are in a half-bridge configuration.

17. The power supply of claim 15 wherein the at least one snubber capacitor includes a first snubber capacitor connected with a first bus line and a second snubber capacitor connected with a second bus line.

18. The power supply of 15 wherein the at least one snubber capacitor is in series with the third and fourth switches and anti-parallel diodes.

19. A method of providing welding power comprising the steps of:

turning on a first power switch and a first snubber switch, and allowing current to flow through the first power switch, a first dc bus, a first power capacitor, and in a first direction through a transformer;

turning the first power switch off and allowing current to flow through the first snubber switch, a second snubber diode, a snubber capacitor, and through the transformer in the first direction, while the first power switch is turning off, to provide a slow voltage transition off;

allowing current to flow through a second anti-parallel power diode, a second DC bus, a second power capacitor, and through the transformer in the first direction, while the first power switch is continuing to turn off, to continue providing a slow voltage transition off;

turning off the first snubber switch;

turning on a second power switch and a second snubber switch after the first power switch is off, and allowing current to flow through the second power switch, the transformer in a second direction, the second power capacitor, and the second bus;

turning the second power switch off and allowing current to flow through the second snubber switch, a first snubber diode, the transformer in the second direction, and a snubber capacitor, while the second power switch is turning off, to provide a slow voltage transition off;

allowing current to flow through a first power diode, the transformer in the second direction, and the first power capacitor, while the second power switch is turning off, to provide a slow voltage transition off;

turning off the second snubber switch; and repeating these steps.

20. The method of claim 19, wherein the steps of turning on the power switches includes soft switching on the power switches.

21. The method of claim 19 wherein the step of allowing current to flow through the second snubber diode and the snubber capacitor includes allowing current to flow through the second snubber diode and a first snubber capacitor and further includes allowing current to flow through the second bus, and the second capacitor.

22. The method of claim 21 wherein the step of allowing current to flow through the snubber capacitor and the second snubber diode includes allowing current to flow through the second snubber diode and a second snubber capacitor and further includes allowing current to flow through the first bus, and the first capacitor.